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REMARK

Claims 1 – 15 are pending in the application. In a telephone conversation on 10/26/2005, Applicants elected to prosecute the invention of Group I (drawn to a graphite article).

Applicants note that claim 15 is dependent on claim 1, for a graphite article. Therefore, claim 15 should be part of the invention of Group 1. Applicants wish to retain claim 15 to continue with the prosecution of invention of Group 1, drawn to a graphite article, and cancel claims 9-14. Applicants further reserve the right to file a divisional application on a later date.

Claims 7 and 8 have been corrected to overcome the informalities pointed out by the Examiner.

Claims 1 and 7 have been amended to clarify the claimed invention. No new matter has been introduced by the amendment. Support for the amendment can be found in paragraph 13, which explains that flatness can be expressed as a deviation angle P. Support can also be found in Paragraph 18, which discloses that in the annealing step, the pyrolytic graphite is heated at a temperature of above 2900°C forming a highly oriented pyrolytic graphite ("HOPG") or sometimes called thermal pyrolytic graphite ("TPG"). In the process "crystallographic changes take place resulting in an improvement in layer plane orientation, a decrease in thickness normal to the layer planes (decrease in the c direction), and an increase in length and width dimensions (increase in the a direction)." Paragraph 19 discloses that hot-pressing the layers in the annealing process treats the bow condition, for TPG feedstock of desired quality to be made. In paragraph 28 or Example 1, PG sheets prepared by a CVD process are "thermally annealed at a temperature of about 2900°C – 3200°C for about 10 minutes to up to 2 hours, wherein the sheets are hot pressed by isotropic graphite plates while being thermally annealed."

The Office Action of Nov. 16, 2005 addressed claims 1-8. Claims 1-8 were rejected. Reconsideration and allowance of claims 1-8 and claim 15 (dependent on claim 1) are respectfully requested in view of the above amendments and the following remarks.

1. Rejection of Claims 1, 4-8 under 35 U.S.C 102 (b) as being anticipated by Taomoto et al (US2002/0021997). The Examiner rejected Claims 1, 4-8 under 35 U.S.C 102 (b) as being anticipated by Taomoto et al. The Examiner indicates that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process. Applicants respectfully traverse this rejection.

For prior art to anticipate under section 102, ***every element*** of the claimed invention must be identically disclosed, either expressly or under principles of inherency, in a single reference. Corning Glass Works v. Sumitomo Electric, 9 U.S.P.Q. 2d 1962, 1965 (Fed. Cir. 1989) (emphasis added).

Applicants respectfully submit that Taomoto et al. does not disclose all the elements in Claims 1, 4-8 as amended. The Examiner will note that in Taomoto et al., "heated polyimide film was rolled pressed into a graphite sheet approximately 100 μm thick" (paragraph 16). With

respect to Example 4, the starting graphite sheet is 200 μm, and the "200 μm-thick ***foamy*** graphite sheet" underwent rolling for ***a finished graphite sheet of 100 μm thick*** (paragraph 32). The claimed invention is directed to a board of annealed thermal pyrolytic graphite having a thickness of ***at least*** 0.2 mm (200 μm).

Applicants further submit that the claimed product is different than that of Taomoto et al. In Taomoto et al., a layer of polyimide film is heated to a maximum temperature of 2700°C (paragraph 15), cooled to room temperature before being roll pressed. The highly oriented pyrolytic graphite of the invention is annealed at a temperature of ***at least 2900°C*** (for improved crystallographic orientation, as explained in paragraph 18).

The claims as amended are directed to a ***feedstock*** of highly oriented pyrolytic graphite ("HOPG") board having a thermal conductivity of greater than 1000 watts/m-K, a size in any dimension of at least 5 cm, a thickness of at least 0.2 mm. As a feedstock, the HOPG board ***consists essentially of a plurality of graphite layers,*** and the HOPG board has a flatness with a deviation angle of less than about 0.075 degrees per mm of thickness, and wherein the annealing is at a temperature of at least 2900°C.

Applicants further direct the Examiner's attention to a Feb. 1, 2006 article at the site http://powerelectronics.com/thermal_management/, wherein the thermal properties of advanced materials used in heat spreaders and heatsinks are discussed. The article discloses that: "HOPG, also called *thermal pyrolytic graphite* and *annealed pyrolytic graphite* by various manufacturers, and diamond particle-reinforced metals and ceramics have the highest thermal conductivities." At www.chemicool.com, a site created by David D. Hsu. of the Massachusetts Institute of Technology to help out anyone involved in chemistry, HOPG is defined to be: "a type of ***pure, highly laminar graphite*** used as an atomic-scale calibration standard for atomic force microscopy and scanning tunneling microscopy."

In paragraph 24 of the specification, it is disclosed that "the finished product ...is a bulk TPG ***stock*** having a thermal conductivity of at least 1000 w/m-K, a size of at least 5 cm in one dimension, e.g., a sheet of 5 cm wide, 10 cm long, and 0.8 cm thick, comprising ***multiple layers*** (similar to shale or mica) of graphite with little or no bow (uneven-ness in the surface of the layers) with the layers being parallel to one another, defined as having a flatness or deviation angle of less than about 0.075 degrees per mm of thickness." As a stock material, the TPG material of the invention ***consists essentially of*** layers of graphite.

Anticipation is held to strict standard of identity, and Taomoto et al. fails identically to disclose the invention. As Taomoto et al. does not disclose each and every single element of the claimed invention, Applicants therefore respectfully request a withdrawal of the §102 rejection over Taomoto et al.

II. Rejection of Claims 2-3 under 35 U.S.C. § 103(a) - Taomoto et al (US2002 / 0021997) in view of Hoover et al (US 6060166): The Examiner rejects claims 2-3 under 35 USC§ 103(a), as being unpatentable over Taomoto et al in view of Hoover. The Examiner indicates that absent a showing of criticality with respect to the length and thickness of the graphite sheet, it would be

obvious to a person of ordinary skill in the art at the time to modify and optimize the graphite sheet to whatever size best suited for its ultimate intended use. The Examiner further asserts that Hoover teaches stacked graphite sheets, with the stacking of graphite sheets makes the graphite more rigid. The Examiner concludes that it would be obvious for one to modify Taomoto with the teaching of stack sheets in Hoover. Applicants respectfully traverse this rejection.

As previously indicated and also well-known in the art, thermal pyrolytic graphite ("TPG") comprises a plurality of crystallographic layers (along the line of shale or mica). In this annealing process of *at least 2900°C*, crystallographic changes take place for the HOPG to have a plurality of crystallographic layers with a thermal conductivity of least 1000 watts/m-K in the finished material. The HOPG board of the invention is made with little or no curve, i.e., with a flatness with a deviation angle of less than about 0.075 degrees per mm of thickness.

In Taomoto et al., a single layer of polymer film of at least 20 μm thick (paragraph 7) undergoes high temperature treatment to a maximum temperature of 2700°C (paragraph 15) then cooled to room temperature before being rolled pressed such that the graphite sheet [has] such flexibility as to withstand repeated bending. Taomoto et al. fails to suggest / teach the formation of a highly oriented pyrolytic graphite having the thickness, the size, and the thermal conductivity of claims 2-3, where in the graphite board consists essentially of a plurality of graphite layers, having very little "bow" or curvy condition with a flatness with a deviation angle of less than about 0.075 degrees per mm of thickness.

In Hoover et al., ***stacked layers of graphite fibers are*** given a preferred orientation (lengthwise) and ***impregnated at regular intervals with stripes of resin*** perpendicular to their length (column 3, lines 54-58), providing a ***flexible*** thermal shunt for removing heat from spacecraft components. Table 1 in Hoover illustrates the thermal conductivity of pyrolytic graphite and copper (as raw material) vs. the Hoover type graphite composite with graphite fibers. Pyrolytic graphite is shown to have a thermal conductivity of 1960 watts/m-K. The Hoover et al. type of graphite fibers is shown to have a thermal conductivity of approximately 570 watts/m-K. Applicants respectfully submit that Hoover teaches away from the present invention with its suggestion to stack layers of graphite fibers with stripes of resin – not a way to make HOPG feedstock with little bow or curve. One also would not wish to introduce stripes of resin into a graphite feedstock to maintain a high thermal conductivity of greater than 1000 watts/m-K.

As Hoover does not make up for the deficiencies of Taomoto et al., the combination of Hoover with Taomoto et al. still does not produce the claimed invention. When the primary reference does not teach all elements of the claimed invention, then the secondary reference must provide those elements in order for the combination of references to contain all the claimed elements as required by law. Applicant therefore respectfully requests a withdrawal of the §103 rejection over Taomoto et al. in view of Hoover.

III. Rejection of Claims 1-3 and 6-8 under 35 U.S.C. § 103(a) over Mariner (US 5863467) in view of Hoover et al (US 6060166): The Examiner rejects claims 1-3 and 6-8 under 35 U.S.C. § 103(a), as being unpatentable over Mariner in view of Taomoto et al. The Examiner indicates

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that Mariner teaches a heat sink made from HOPG with one embodiment with a thickness of 4 mm. Again, the Examiner indicates that absent a showing of criticality with respect to the length and width of the graphite sheet, it would be obvious for one of ordinary skill modify and optimize the graphite sheet to whatever size best suited for stock materials for being cut into heat sinks. Applicants respectfully traverse this rejection.

The Mariner reference relates to a ***composite composition of HOGP flakes and a polymeric binder*** wherein the bulk layers of platelets or flakes are better aligned to improve the thermal conductivity of the composition. Figure 1 in Mariner shows that the composite composition has a thermal conductivity of up to 400 Watts/m-K. Mariner does not disclose nor suggest a feedstock TPG board consisting essentially of a plurality of graphite crystallographic layers having a thermal conductivity of greater than 1000 watts/m-K, and that the board is annealed while being hot pressed for an essentially flat board or sheet.

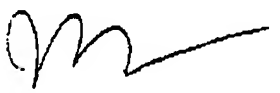
As previously discussed, in Hoover et al., ***stacked layers of graphite fibers are*** given a preferred orientation (lengthwise) and ***impregnated at regular intervals with stripes of resin,*** providing a ***flexible*** thermal shunt. Both Mariner and Hoover et al. teach away from the invention with the suggestion to incorporate polymeric resin into the graphite, graphite flakes in Mariner and graphite fibers in Hoover. The combination of Mariner and Hoover et al. still does not produce the claimed invention. Neither reference discloses or suggests a feedstock HOPG board consisting essentially of a plurality of graphite crystallographic layers having a thermal conductivity of greater than 1000 watts/m-K the with little bow or curve, and having a size in any dimension of at least 5 cm, a thickness of at least 0.2 mm.

As the Examiner has not made a prima facie case of obviousness, Applicant therefore respectfully requests a withdrawal of the §103 rejection over Mariner in view of Hoover et al., and an allowance of the claims.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 50-2339.

Respectfully submitted,



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